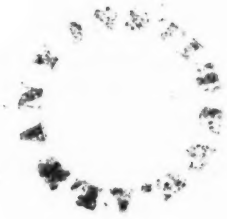

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PHRENOLOGY.

[As there is a considerable agitation at the present period respecting phrenology, we trust that many of our readers are desirous to know something of the subject, who, nevertheless, are not prepared to bestow much, either of time or of money in the pursuit of it. We have accordingly furnished them with the following article, the principal part of which, may be found in that excellent work, the Encyclopædia Americana. The reader will be pleased to consider it as in no way implicating our sentiments, but merely a true representation of the science as advanced by its advocates. We do not feel competent to decide on the accuracy and completeness of the mental and cerebral survey executed by Messrs. Gall and Spurzheim, nor profess to judge of the exactness and fidelity with which the numerous positions are marked down in their very complete and well-filled map of the brain. They appeal to observation for the confirmation or refutation of their statements; but our observations are not numerous or varied enough for these purposes. No one can refuse to them the merit of patient inquiry, careful observation, and unprejudiced reflection. They have performed the useful service of rescuing us from the trammels of doctrines and authorities, and directing our attention to nature, whose instructions cannot deceive us. Whether the views of Gall and Spurzheim may be verified or not, our labors in this direction must be productive, and must bring with them many collateral advantages. Although we are not desirous to make our pages the *arena* of controversy, if any one wishes to refute or confirm their views, we will most cheerfully act on the equitable principle of *audi alteram partem*.]

'PHRENOLOGY (from *phren*, mind, and *logos*, science); also called *craniology*; the doctrine first systematically exhibited by doctor Gall, of the formation and functions of the nervous system, and particularly of that portion of it which is enclosed in the skull,

and composes what is called the *brain*: hence the name *craniology*, from *kranion*, the skull, and *logos*, science. To give another definition, "phrenology treats of the faculties of the human mind, and of the organs by means of which they manifest themselves; but it does not enable us to predict actions." The origin of this branch of physiology, has been touched upon in the account of its author. He published his observations in a work entitled *Anatomie et Physiologie du Systeme nerveux en general et du Cerveau en particulier* (Paris, 1801 et seq., 4to.), and illustrated them by numerous engravings in folio. The chief points of his doctrine are the following. The brain is that organ of the body by which the mind of man exerts its activity. It is, however, not active in all its parts in every act of thinking; but, as every sense, every organ of motion, and, in general, every function of the body, has a particular nerve, or set of nerves, as its instrument, so every operation of the mind essentially different from the others has a separate part of the brain for its organ, which is indispensable to it. The strength and size of the nerve, are in proportion to the power of action belonging to this organ. The nerve of the trunk of the elephant has the strength of a child's arm. Man's brain is more complex than that of any other member of the whole animal creation. It not only unites all those organs which are found singly in the brains of other animals, but has also others which are not found in them. The skulls of men exhibit great varieties, as well in the quantity of the brain, as in the elevation of certain points; and observation teaches that the better sort of heads are distinguished, if not by a greater circumference of the whole skull, yet by the prominence of peculiar elevations, that is, by a greater mass of brain at those points. In youth, the period of developement, and the time of the formation of the dispositions, the whole brain has a tendency towards expansion. If the upper part of a young skull is taken off, the brain forces itself out, and cannot be pressed back into the same space by replacing the part of the skull: with an old skull, precisely the contrary is observable. The functions of certain parts of the brain are different from each other, and independent of each other, and those parts of the skull which cover them, are distinguished by peculiar forms. The brain is a convolution of organs. The point of union of all the nerves must be considered to be where the spinal marrow and the brain join in the neck at a spot, by pressure on which any animal possessing a brain is easily killed. Part of the nervous substance descends as spinal marrow, gives out nerves to all the organs of the body, and is distributed at last entirely into nervous ramifications. The second part ascends into the cavity of the

skull, gives out branches to the cerebellum, and diffuses itself in the forms of rays, through the whole mass of the cerebrum, or rather composes it, leaving, however, in four places empty spaces (the ventricles). The variety of functions is expressed by an equally great variety in form and color. The organs of the brain are double. The whole mass of brain may be divided into two equal hemispheres, and singleness takes place only where those organs are supposed to exist, which seem to be destined to unite all the activities in a common consciousness: hence, if an organ in one part is deficient, the other part may still be active; so that the function belonging to them may still be performed; as one kidney may be wanting without a total suppression of the secretion of urine. Those organs which are found in all animals provided with a brain, (such as have the most immediate connexion with the maintainance of the vital energy), are situated towards the base of the skull; but, when the brain becomes nobler by the addition of organs of more elevated faculties, these additional organs are found towards the upper and outer parts of the skull. In a similar way, the increase of some parts of the brain shows itself by prominence beyond the others. The skull itself is in a passive state, that is, its form is determined, by the surface of the brain, and does not press on the brain, if in a healthy or natural condition; for the brain exists even in the fœtus, before the formation of the skull. It is then only surrounded by the hard membrane called the *dura mater*, which has to form and to nourish the skull. The bones of the skull consist, in adults, of two laminæ, between which lies a marrowy *diploe*. Nevertheless, the two laminæ are every where parallel with each other, except at a few points. Accurate and continued observation and comparison of men, says the phrenologist, have shown that particular elevations of the skull allow us to infer a great developement of the dispositions or faculties belonging to the organs under these protuberances, but that, where all the functions are developed harmoniously (as in Wieland's head), the skull forms no abrupt elevations, but an even arch. The observation of men in different situations, and with peculiar dispositions and faculties, and of the skulls of such individuals, anatomico-physiological investigations of the brain, and particularly comparative anatomy, with particular reference to the disposition or faculty by which particular animals are distinguished, and to the peculiar character of their skulls; pathological observations of persons suffering in the brain or the mind, as of cretins, idiots, insane persons, or persons whose brains have been injured by external violence, experiments with animals (not unfrequently cruel ones), by wounding or destroying certain parts

of the brain, &c., furnish the facts on which phrenology rests. By means of such observations, Gall considered that he had found the parts of the brain belonging to several faculties and dispositions. These, as far as they can be discovered by observation of the exterior of the skull, are, of course, only such as are situated towards the surface of the brain: a number of others, situated deeper, and towards the centre, may, indeed, be conjectured at present, but can only be ascertained by continued study. Whatever may be the opinion respecting phrenology, it is certain that the observations of Gall, and other phrenologists, are highly remarkable; and Gall's idea is not, as some have asserted, immoral, and founded on materialism. From times immemorial, it has been known that men are born, not only with different faculties of intellect, but also with different moral dispositions, which is true both of single individuals, and of whole nations, and the phrenologist only strives to find the organic cause of these differences, which is as innocent as to ascribe peculiar dispositions to the influence of climate. The phrenologist does not say that these dispositions cannot be overcome; but who does not know that moral efforts are much more difficult to some persons than to others? The individual organs, according to the classification nomenclature of doctor Spurzheim's New Physiognomical System, published in 1815, are as follows. A faculty is admitted as primitive if it exists in one kind of animal and not in another; varies in the two sexes of the same species; is not proportionate to the other faculties of the same individual; does not manifest itself simultaneously with the other faculties (appears and disappears earlier or later in life than other faculties); may act, or rest singly; may singly preserve its proper state of health or disease. The organs are divided into those of the *propensities*, the *sentiments*, and the *intellect*.'

I. Propensities.

The faculties falling under this genus, do not form ideas; their sole function is to produce a propensity of a specific kind. These faculties are common both to man and other animals.

1. *Amativeness.* The cerebellum is the organ of this propensity, and it is situated between the mastoid process on each side, and the projecting point in the middle of the transverse ridge of the occipital bone.* The size is indicated during life by the thickness of the neck at these parts. In new-born children the cerebellum is the least developed of all the cerebral parts. It is, to the brain, as one to thirteen, fifteen, or twenty, and in adults

* For illustration of these, see Plate ix.

as one to six, seven, or eight. It attains its full size from eighteen to twenty-six. It is less in females, in general, than in males. In old age it frequently diminishes.

2. *Philoprogenitiveness.* This organ is situated immediately above the middle part of the cerebellum, and corresponds to the protuberance of the occiput. It is generally longer in females than in males. When it is large, it gives a drooping appearance to the hind part of the head. The chief function of the faculty is to produce the instinctive love of offspring in general. This feeling is distinct from benevolence; for we frequently find it strong in selfish individuals, who manifest no compassionate feeling towards adults. It is generally distinct from self-love, for sometimes the most generous are passionately fond of children, and occasionally the most selfish are indifferent about them.

3. *Concentrativeness.* This organ is situated immediately above the one last named, and below self-esteem. It was first called by Spurzheim, *inhabitativeness*, as it was found in persons and other animals much attached to one place; but now it is believed that its function is to maintain two or more powers in simultaneous and combined activity.

4. *Adhesiveness.* This organ is located on each side of concentrativeness, higher up than philoprogenitiveness, and just above the lambdoidal suture. It produces an instinctive tendency to attach one's self to surrounding objects, animate and inanimate. Those persons in whom it is very strong, feel an involuntary impulse to embrace and cling to the object of their affections. It disposes to friendship and society in general, and gives ardor to the shake of the hand. In boys, it frequently indicates itself by attachment to dogs, horses, birds, etc. In girls it shows itself by affectionate embraces of the doll. It is stronger, and the organ is larger, in women than in men. When too strong, it causes excessive regret at the loss of a friend, or excessive uneasiness at leaving one's country.

5. *Combativeness.* This organ is situated at the inferior and mastoid angle of the parietal bone. It produces active courage, and when energetic, the propensity to attack. A considerable endowment is indispensable to all great and magnanimous characters. It gives that boldness to the mind, which enables it to look undaunted on opposition, to meet, and, if possible, to overcome it. When very deficient, the individual cannot resist attacks, and is incapable of making his way when he must invade the prejudices or encounter the hostilities of others. When too energetic, it inspires with the love of contention for its own sake; leads to a fiery and quarrelsome disposition; and pleasure may then be felt in disputation or in fighting.

6. *Destructiveness.* This organ is situated immediately above, and extends a little backwards and forwards from the external opening of the ear, and corresponds to the squamous plate of the temporal bone. The faculty produces the impulse, attended with desire to destroy in general. It prompts us to exterminate obstacles, so that they may never rise up to occasion fresh embarrassment. When energetic, it gives a keen and impatient tone to the mind, and adds activity and force to the whole character. Anger and rage are manifestations of it, which being analyzed, are threats of unpleasant consequences, or, vengeance to those who transgress our commands, or encroach on our rights. Hence, it gives weight to injunction, by inspiring with dread of suffering in case of disobedience. It is essential to satire; and inspires authors to write cuttingly, with a view to lacerate the feelings of their opponents. When very deficient, there is a lack of fire in the constitution; the mind, as it were, wants edge, and the individual is prone to sink into passive indolence. The organ is conspicuous in the heads of cool, deliberate murderers, and in persons habitually delighting in cruelty; it is likewise prominent, in the head of the sportsman, and prompts him to bear with cheerfulness the fatigues of hunting, with the uncertainty of capture. It is also generally large in those who are fond of seeing public executions, floggings, and the infliction of pain in all its forms.

7. *Constructiveness.* This organ is situated at that part of the frontal bone immediately above the spheno-temporal suture. In man, the faculty inspires with the tendency to construct in general, and the particular direction in which it is exerted, depends on the other predominant faculties of the individual; for example, if combined with large combativeness and destructiveness, it may be employed in fabricating implements of war; if joined with veneration predominating, it may tend towards erecting places of religious worship. If united with large form, imitation, and secretiveness, it may inspire with a love of portrait painting. In the lower order of animals, it appears to be directed, in a great measure, to one special object; in a bird, to a particular form of nest, in the beaver, to a special fashion of hut; in the bee, to an unerring form of cell,—these animals being deficient in the generalizing and directing powers conferred on men. The organ is indispensable to all who follow operative mechanical professions.

8. *Acquisitiveness.* This organ is situated at the anterior inferior angle of the parietal bone. Spurzheim first called it *covetiveness.* The faculty produces the tendency to acquire, and the desire to possess in general, without reference to the uses to which the objects, when obtained, may be applied. The idea of prop-

erty is founded on it. It takes its direction from other faculties, and hence, may lead to collecting coins, paintings, minerals, and other objects of curiosity and science, as well as money. Idiots, under its influence, are known to collect things of no intrinsic value. This instinctive tendency to acquire and to accumulate, is the foundation of wealth, and of the conveniences and luxuries of civilized society.

9. *Secretiveness.* This organ is situated at the inferior edge of the parietal bones, immediately above destructiveness, or in the middle of the lateral portion of the brain. This faculty produces instinctive tendency to conceal spontaneous thoughts, emotions, etc., from outward expression, until the understanding shall have decided on their propriety and probable consequences. Besides, man and other animals are occasionally liable to the assaults of enemies, which may be avoided by concealment, in cases where strength is wanting to repel them by force. Nature, therefore, by means of this propensity, enables them to act with prudence, slyness, or cunning, according to the dictates of the other faculties possessed by the individual, to their other means of defence. The organ has been found large in actors, and in those who excel in the imitative arts.

II. Sentiments.

These faculties, like those which we have already considered, do not form specific ideas, but produce merely a *sentiment*; that is, a propensity, connected with an emotion, or feeling of a certain kind. Several of them are common to man and the lower animals; others are peculiar to man.

Sentiments common to man and other animals.

10. *Self-Esteem.* This organ is situated at the vertex or top of the head, a little above the posterior or sagittal angle of the parietal bones. This faculty produces the sentiment of self-esteem or self-love in general. If modified by other organs, it is the source of great good. The lower animals, such as the turkey-cock, peacock, horse, etc., manifest feelings resembling pride or self-esteem. Nations differ in regard to the degree of this sentiment. The English have more of it than the French, and hence the manner of a genuine Englishman appears to a Frenchman, cold, haughty, and supercilious. When the organ becomes excited by disease, the individual is prone to imagine himself a king, emperor, or a transcendant genius, and some have fancied themselves even the Supreme Being.

11. *Love of Approbation.* This organ is situated on each side of that of self-esteem and commences about half an inch from the

lambdoidal suture. The faculty produces the love of the esteem of others, expressed in praise or approbation. A due endowment of it is indispensable to an amiable character. It induces its possessor to make active exertions to please others, and also to suppress numberless little manifestations of selfishness, and to restrain many peculiarities of temper and disposition, from the dread of incurring their disapprobation. It is the butt upon which wit strikes, when, by means of ridicule, it drives us from our follies. To be laughed at, is worse than death to a person in whom this sentiment is predominant. The direction in which gratification will be sought, depends on the other faculties with which it is combined in the individual. If the moral sentiments and intellect be vigorous, it will desire an honorable fame, and hence animates and excites the poet, painter, orator, warrior, and statesman. When too energetic, and not regulated by the higher powers, it produces great abuses; it then gives rise to a fidgety anxiety about what others will think of us, which is at once subversive of happiness and independence. It renders the mere *dicta* of the society in which the individual moves, his code of morality, religion, taste, and philosophy; and incapacitates him from upholding truth or virtue, if disowned by those whom he imagines influential or genteel. It then overwhelms the artist, author, or public speaker with misery, if a rival is praised in the journals in higher terms than himself. A lady is then tormented at perceiving, in the possession of her acquaintance, finer dresses or equipages than her own. It excites the individual to talk much of himself, his affairs, and connexions, so as to communicate to the auditor vast ideas of his greatness or goodness; in short, vanity is one form of its abuse. This organ is very powerful in some of the lower order of animals, as the dog, horse, etc.

12. *Cautiousness.* This organ is situated near the middle of each parietal bone, where the ossification of the bone generally commences. The faculty produces the emotion of fear in general, and prompts its possessor to take care, and hence it is named *cautiousness.* A due degree of it is essential to a prudent character. The tendency of it is, to make the individual in whom it is strong, hesitate before he acts, and, from apprehending danger, to trace consequences, that he may be assured of his safety. A great and involuntary, but momentary activity of it, occasions a *panic*, a state in which the mind is hurried away by an irresistible emotion of fear, disproportioned to the outward occasion. The organs are generally largely developed in children; and, in some instances, are so prominent, as to alarm mothers with the fear of disease or deformity. Such children may be safely trusted to

take care of themselves; they will be rarely found in danger. Many of the lower animals, as the hare, rook, etc., possess the organ largely developed.

13. *Benevolence.* This organ is situated at the upper part of the frontal bone, in the coronal aspect, and immediately before the fontanel. The faculty produces the desire of the happiness of others, and disposes to compassion and active benevolence. It communicates mildness and cheerfulness to the temper, and disposes the possessor to view charitably the actions and characters of others. The lower animals possess this organ, but the faculty in them seems to be limited, in a great degree, to the production of passive mildness of disposition. Dogs, horses, monkeys, etc., which have the corresponding part of the forehead large and elevated, are mild and pacific; those on the other hand, in which it is small and depressed, are ill-natured. It is depressed in all the ferocious tribes of animals, and also in nations remarkable for cruelty.

Sentiments Proper to Man.

14. *Veneration.* This organ is situated at the middle of the coronal aspect of the brain, at the bregma or fontanel of anatomists. The faculty produces the sentiment of respect and reverence; and when directed to the Supreme Being, leads to adoration. It predisposes to religious feeling, without determining the manner in which it ought to be directed; so that if the understanding be very unenlightened, it may be gratified with the worship even of images or idols. It is the source also of the tendency to look up to, and admire superiors in rank and power; and, in this way, disposes to obedience. It gives rise to the profound emotions of respect experienced by many, when looking on the ruins of a palace or temple, the graves of their forefathers, or the former habitations of men eminent for genius or virtue. It enters largely into the constitution of a devoted antiquary. It is also the chief element in filial piety.

15. *Hope.* This organ is situated on each side of that of veneration, and extends under part of the frontal and part of the parietal bones. The faculty produces the sentiment of hope, in general, or the tendency to believe in the possibility of what the other faculties desire, but without giving the conviction of it, which depends upon reflection. It inspires with gay, fascinating, and delightful emotions, painting futurity fair and smiling as the regions of primeval bliss. It gilds and adorns every prospect with shades of enchanting excellence; while cautiousness hangs clouds and mists over distinct objects, seen by the mind's eye.

When too energetic and predominant, it disposes to credulity, and, in mercantile men, leads to rash and inconsiderate speculation.

16. *Ideality.* This organ is situated nearly along the lower edge of the temporal ridge of the frontal bone. The faculty produces the feeling of exquisiteness and perfectibility, and delights in the *beau ideal.* The knowing and reflecting faculties perceive qualities as they exist in nature; but this faculty desires something more exquisitely lovely, perfect, and admirable, than the scenes of reality. It tends to elevate and endow with splendid excellence every object conceived by the mind; and stimulates the other faculties to create scenes and objects invested with the qualities which it delights to contemplate, rather than with the degree of perfection which nature usually bestows. It is the faculty which inspires with exaggeration and enthusiasm, which prompts to embellishment, and splendid conceptions. It is essential to the poet, painter, sculptor, and all who cultivate the fine arts.

Wonder. Immediately above ideality, a blank space appears in the busts and plates of the head; the function of this part of the brain was not ascertained when the other organs were numbered, and it was therefore unmarked. Dr. Spurzheim states that the faculty connected with this organ, produces the tendency to believe in inspirations, presentiments, phantoms, etc.

17. *Conscientiousness.* This organ is situated on the posterior and lateral parts of the coronel surface of the brain, upwards from cautiousness, and backwards of hope. The faculty produces the feeling of obligation, incumbency, right and wrong.

18. *Firmness.* This organ is situated at the posterior part of the coronel surface of the head, close upon the middle line. It is difficult to analyze and distinguish the ultimate principle of the faculty. Its effects are sometimes mistaken for *will*; because those in whom it is large are prone to use the phrase 'I will,' with great emphasis, which is the natural language of determination; but this sentiment is different from proper volition. It produces determination, constancy, and perseverance. Fortitude, as distinguished from active courage, results from it. When powerful, it gives a fixed, forcible, and emphatic manner to the gait, and a corresponding tone to the voice. It is indispensable to the attainment of excellence in any difficult department of art, science, or business. It gives, however, perseverance only in manifesting the faculties which are possessed by the individual in adequate strength.

III. Intellect.

These faculties communicate to man and other animals, knowl-

edge of their own internal sensations, and also of the external world; and their object is to know existence, and to perceive qualities and relations. They consist of the *five senses*, which convey the impressions to the various organs, the province of which is, to form ideas of such qualities; *those powers which take cognizance of external objects*, called the *knowing faculties*, the object of which is attended with a sensation of pleasure; and the *faculties which trace abstract relations, and reason, or reflect*; which produce ideas of reason and reflection.

19. *Individuality.* This organ is situated in the middle of the lower part of the forehead. Two places are marked with the same number, 1-19 and 2-19. The faculty gives the desire, accompanied with the ability, to know facts and things, without determining the kind of knowledge, and without any view to the purposes to which it may be subservient. Its organ is early and largely developed in children, and the faculty is strongly developed by them. It is of importance, not only in philosophy, but in the affairs of life. It prompts to observation, and to investigation by experiment; and is a great element in a genius for those sciences which consist in a knowledge of specific existences. It greatly aids in producing a talent for all practical business involving details, and hence to the medical practitioner, the lawyer, and the merchant, it is of essential advantage. To the orator or the author, it communicates that power of observation which enables him to seize objects and incidents presented to his mind, to store them up, and to recall and apply them, when required, so as to give substance to his mental productions. This organ is possessed by the lower animals. Dr. Gall considers the faculty in them to produce the capacity for education, and he gives a scale of the heads of animals, from the crocodile and frog to the elephant, with the view of proving, that the more this part of the brain is developed in each species, the higher are its susceptibilities of being tamed and taught.

20. *Form.* The size of this organ is indicated by the distance between the eyes; the different degrees of which correspond to the greater or less developement of the portions of brain situated on the mesial or inner side of the orbitary plates of the frontal bone, on each side of the *crista galla*. The function of the organ is to judge of form. It aids the mineralogist, the portrait painter, and all persons engaged in the imitative arts. It gives the power also of distinguishing faces.

21. *Size.* Persons are found who have an intuitive facility in estimating size, and in whom the powers of distinguishing form and relative position are not equally strong; and the part of the

brain under No. 21., has been observed in such individuals to be large. It gives the power of perceiving and judging of perspective. Some officers in the army, in forming their companies into lines, estimate the space which the men will occupy, with perfect accuracy, and others can never learn to judge correctly of this requisite; and the organ has been observed largely developed in the former. Locality also may conduce to this talent.

22. *Weight or Resistance.* There seems to be no analogy between the weight or resistance of bodies, and their other qualities. They may be of all forms, sizes, and colors, liquid or solid, and yet none of these features would necessarily imply, that one was heavier than the other. This quality, therefore, being distinct from all others, we cannot logically refer the cognizance of it to any of the faculties of the mind, which judge of the other attributes of matter; and, as the mental power undoubtedly exists, there appears reason to conjecture, that it may be manifested by means of a special organ. Persons who excel in archery and quoits, also those who find great facility in judging of momentum, and resistance in mechanics, one observed to possess the parts of the brain lying nearest to the organ of size largely developed.

23. *Coloring.* Several of the metaphysicians were aware, that a person may have very acute vision, and yet be destitute of the power of distinguishing colors; but habit and attention have, as usual, been adduced to solve the difficulty. Observation shows, that those who have a great natural power of perceiving colors, have a large developement of that portion of the brain situated under the middle of the arch of the eyebrows, enclosed by the lines 23; while those who cannot distinguish minute shades of color, have this portion small. A large endowment of this faculty renders the sight of flowers and enamelled meadows pleasing. It aids the flower painter, enameller, dyer, and, in general, all who occupy themselves with colors. Its great energy gives a passion for colors, but not necessarily a delicate taste in them. Taste depends upon a perfect, rather then a very powerful activity of the faculties.

24. *Locality.* The frontal sinus occurs occasionally, but not generally at the seat of locality, at the lower part of the forehead, over the inner end of the eyebrows. This faculty conduces to the desire for traveling, and constitutes a chief element in the talent for topography, geography, astronomy, and landscape painting. It gives what is called, *coup d' œil*, and judgment of the capabilities of ground. It is necessary to the military draughtsman; and is of great importance to a general in war. The lower order of animals possess the faculty and organ; and display great pow-

ers of retracing their way, when removed from their habitations. The instinctive tendency of several species of them to migrate at certain seasons, is inferred to be connected with the periodical excitement of this organ.

25. *Order.* Order supposes a plurality of objects; but one may have ideas about a number of things and other qualities, without considering them in any order whatever. There are individuals who are martyrs to the love of order, who are distressed beyond measure, by the sight of confusion, and highly satisfied when everything is well arranged. These persons have the organ in question large. The faculty of which we speak, gives method and order in arranging objects, as they are physically related; but philosophical or logical in ferences, the conception of systematizing or generalizing, and the idea of classifications, are formed by the reflecting faculties. Spurzheim relates, that the Sauvage de l'Aveyron at Paris, though an idiot in a very high degree, cannot bear to see a chair or any other object out of its place; and as soon as anything is deranged, he, without being excited to it, directly replaces it. He saw also in Edinburgh, a girl, who, in many respects was idiotic, but in whom the love of order was very active. She would avoid her brother's apartment, in consequence of the confusion which prevailed in it.

26. *Time.* The power of conceiving time, and of remembering circumstances connected by no link, but the relation in which they stand to each other in chronology, and also the power of observing time in performing music, is very different in different individuals. The special faculty seems to be the power of judging time, and of intervals in general. By giving the perception of measured cadence, it appears to be the chief source of pleasure in dancing. It is essential to music and versification.

27. *Number.* Some individuals, remarkable for their great talent of calculating, excited the attention of Dr. Gall. He found those, even in children, who excelled in this faculty. He mentions a boy of thirteen years old, who learned with facility a very long series of numbers, performed the most complicated arithmetical calculations from memory, and very soon found their true result. Similar talents were manifested in Zerah Colburn and several others, whom we might enumerate. In such individuals, the arch of the eyebrow is either much pressed downward, or there is an elevation at the external angle of the orbit. It is still doubted whether the lower animals possess this organ and faculty or not.

28. *Tune.* This organ bears the same relation to the ears, as the organ of color does to the eyes. The faculty gives the perception of melody; but this is only necessary in a genius for mu-

sic. Time is requisite to a just perception of intervals; ideality, to give elevation and refinement; secretiveness and imitation, to produce expression; and constructiveness, form, weight, and individuality are requisite besides, to supply the mechanical expertness, necessary to successful performance. Dr. Spurzheim observes, that the heads and skulls of birds which sing, and those which do not sing, and the heads of the different individuals of the same kind, that have a greater or less disposition to sing, present a conspicuous difference at the place of this organ. The heads of males, for instance, and those of females of the same kind of singing birds, are easily distinguished by their different developement.

29. *Language.* A large developement of this organ is indicated by the prominence and depression of the eyes; this appearance being produced by convolutions of the brain, situated in the posterior and transverse part of the upper orbitary plate, pressing the latter, and with it the eyes, more or less forward, downward, and outward, according to the size of the convolutions. The special faculty of this organ is, to enable us to acquire a knowledge of, and to give us the power of using artificial signs or words. Persons who have a great endowment of it abound in words. In ordinary conversation their language flows like a copious stream—in a speech, they pour out torrents. Individuality and comparison greatly assist this faculty, when applied to the acquisition of foreign languages and grammars.

Reflecting Faculties.

30. *Comparison.* This is an eminence of the form of a reversed pyramid, in the upper and middle portion of the frontal bone, and gives the power of perceiving resemblances, similitudes, and analogies. Tune may compare different notes; color contrast different shades; but comparison may compare a shade and a note, a form and a color, which the other faculties by themselves could not accomplish. In popular preachers, this organ is generally fully developed. It is more rarely deficient than any other intellectual organ; and the scripture is addressed to it in a remarkable degree, being full of analogies and comparisons. It tends to the invention and use of figurative language; and the speech of different nations is more or less characterized by this quality, according to the predominance of the organ.

31. *Causality.* This faculty is situated between comparison and wit, and furnishes the idea of *causation*, as implying something more than mere juxta-position or sequence,—and as forming an invisible bond of connexion between cause and effect. It impress-

es us with an irresistible conviction, that every phenomenon or change in nature is caused by something, and hence, by successive steps, leads us to the First Cause of all. It induces us on all occasions, to ask, *why*, and *wherefore*, is it so? It gives deep penetration, and the perception of logical consequences in argument. It is large in persons who possess a natural genius for metaphysics political economy, or similar sciences.

32. *Wit* is situated at the prominent and rounded anterior superior lateral parts of the forehead. When this developement is excessively large, it is attended with a disposition apparently irresistible, to view objects in a ludicrous light. When joined with combativeness and destructiveness large, it leads to satire; and even friends will then be sacrificed for the sake of a joke. It gives the talent also, for epigrams.

33. *Imitation.* This is situated at the superior-anterior part of the forehead. The faculty gives the power of imitation in general; and when joined with secretiveness, it gives expression in the fine arts. It is indispensable to portrait painters, sculptors, and engravers; and it gives the tendency, in speech and conversation, to fit the action to the words. It is generally active, and the organ large in children.

We refer those who wish to pursue the subject, to a popular treatise on Phrenology, by George Combe, and also the works of Gall and Spurzheim. There exists also in England, a phrenological society, who publish a phrenological journal.

CONCHOLOGY.

NO. VII.

OF THE HABITATION OF TESTACEOUS ANIMALS. To the detailed account which we have given of the natural history of testaceous animals, and particularly of the formation and growth of the shell, we have only to add a few observations concerning their habitation, the method of fishing, collecting and preserving them.

Testaceous animals are found in every part of the surface of the globe. Some are inhabitants of the land, while others only frequent rivers and lakes, and a third and numerous class live in the ocean. From this a classification of shells has been formed, and they have been divided into land, fresh water, and sea shells. But whatever difference might exist in the habits and

economy of testaceous animals which are produced in places so different, it affords few marks of discrimination for the purpose of classification.

Land shells are spread over the whole surface of the earth, and although more accessible, are perhaps less known than those which inhabit the ocean. From the small number of land shells which have been collected, it would appear, at first sight, that they are less numerous than marine shells.. This, however, seems not to be the case, with regard to the number of species; and it is well known, that the number of individuals of land shells, in some instances, far exceeds that of sea shells. The sea shells of the Mediterranean have been observed by naturalists, to be nearly the same from the straits of Gibraltar to the island of Sicily; but the land shells of Languedoc are different from those of Provence, of Dauphiny, Peidmont, and different parts of Italy. Some are found in Spain, in Corsica, in Sardinia and Sicily, which are not to be met with in other places; and from the great variety and number of land shells, it seems probable that many of them are yet unknown. But let us now take a general view of those places of the world, where different testaceous animals are most frequently found.

It has been already observed, that light and heat have very considerable influence in adding to the splendor of the colors of shells. The most beautiful shells are found in countries between the tropics where they are more immediately subject to the direct rays of the sun, and a higher temperature. From these causes, the shells produced in these countries have a lustre and brilliancy, which those of colder climates never possess.

The shores of Asia furnish us with the pearl oysters and scallops in great perfection. About Amboyna, are found the most beautiful specimens of the cabbage shell, the *arrosoir*, the *ducal mantle*, and the coral or echinated oysters. Here also are found a great variety of extremely beautiful muscles, tellinæ, and volutæ; some fine buccinums, and the shell called the *Ethiopian crown* in its greatest perfection. The dolia, the murices, and the cassandræ, are also found on these coasts in great beauty. Many elegant snails and screw shells are also brought from thence; and finally the scorpion and spider shells. The Maldive and Philippine islands, Bengal, and the coast of Malabar, abound with the most elegant of all the species of snails, and furnish many other kinds of shells in great abundance and perfection. China abounds in the finest species of porcelain shells, and has also a great variety of beautiful snails. Japan furnishes us with all the thicker and larger bivalves; and the isle of Cyprus above all other parts of the

world, for the beauty and variety of the patella or limpet found there.

America affords very many elegant shells, but neither in so great abundance nor beauty as the shores of Asia. Panama is famous for the cylinders or rhombi, and we have besides, from the same place, some good porcelains, and very fine species of *dolium*, or *Concha globosa*, called from this place, the *Panama purple shell*. One of the most beautiful of the cylinders, is also known among naturalists, under the name of the *Panama shell*. About Brazil, and in the gulf of Mexico, there are found murices and dolia of extreme beauty; and also a great variety of porcelains, purpuræ, pectens, neritæ, bucardiæ, or heart shells, and elegant limpets. The island of Cayenna affords one of the most beautiful of the buccinum kind, and the Midas ear is found principally about this place. Jamaica and the island of Barbadoes have their shores covered with porcelain, chamæ, and buccina; and at St. Domingo, there are found almost all the same species of shells that we have from the East Indies; only they are less beautiful, and the colors more pale and dead. The pearl oyster is found also on this coast, but smaller than in the Persian Gulf. At Martinico there are found in general, the same shells as at St. Domingo, but yet less beautiful. About Canada are found the violet chamæ; and the lakes of that country abound with muscles of very elegant pale blue and pale red colors. Some species of these are remarkably light and thin; others are very thick and heavy. The Great Bank of Newfoundland is very barren in shells; the principal kind found there, are muscles of several species, some of which are of considerable beauty. About Carthagena there are many mother of pearl shells, but they are not of so brilliant colors as those of the Persian gulf. The island of Magellan, at the southern point of America, furnishes us with a very remarkable species of muscle called by its name; and several very elegant species of limpets found there, particularly the pyramidal.

In Africa, on the coast of Guinea, there is a prodigious quantity of that small species of porcelain which is used there as money; and there is another species of porcelain on the same coast which is all over white; the women make bracelets of the latter, and the people of the Levant adorn their hair with them. The coast of Zanguebar is very rich in shells; we find there a vast variety of the large porcelains, many of them of great beauty, and the *Nux maris*, or sea nut, is very frequent there. Beside these and many other shells, there are found on this coast all the species of nautili, many of which are very beautiful. The Canary Isles abound with a vast variety of the murices, and some other good shells; and we have

from Maderia great variety of the echine, or sea eggs, different from those of the European seas. Several species of muscle are also common there, and the sea ears are nowhere more abundant.

The Red Sea is beyond all other parts of the world abundant in shells; scarcely any kind is wanting there; but what we principally have from thence are the purpuræ, porcelains and the echine marini.

The Mediterranean and Northern Ocean contain a great variety of shells, and many of very remarkable elegance and beauty; they are upon the whole, however, greatly inferior to those of the East Indies. The Mediterranean abounds much more in shells than the Ocean. The gulf of Tarentum affords great variety of purpuræ, of porcelains, nautili, and elegant oysters; the coasts of Naples and Sardinia afford also the same, and with them a vast number of the solens of all the known species. The island of Sicily is famous for a very elegant kind of oyster which is entirely white; pinnæ marinæ and porcelains are also found in great plenty there, with tellinæ and chamæ of many species, and a great variety of other beautiful shells. Corsica is famous, beyond all other places, for the vast quantities of the pinnæ marinæ; and many other very beautiful shells, are found there. About Syracuse are found the gondola shell, alated murex, and a great variety of elegant snails, with some of the dolia and neritæ. The Adriatic Sea, or Gulf of Venice, is less furnished with shells than almost any of the seas thereabout. Muscles and oysters of several species are however found there, and some of the cordiform or heart shells; there are also some tellinæ. About Ancona there are vast numbers of the pholadas buried in stone, and the sea ears are particularly frequent about Pizzoli.

The ports of Marseilles, Toulon, and Antibes, are full of pinnæ marinæ, muscles, tellinæ and chamæ. The coasts of Bretagne afford great numbers of the conchæ anatiferæ and pousse peids; they are found on old rotten boards, on sea substances, and among clusters of sponges. The other ports of France, as Rochelle, Dunkirk, Brest, St. Maloes, and others, furnish oysters excellent for the table, but of the common kind and of no beauty in their shells; great numbers of muscles are also found there; and the common tellinæ, the onion peel oysters, the solens and the conchæ anatiferæ, are also found there. At Granville, in Lower Normandy, there are found very beautiful pectens, and some of the cordiform or heart shells.

The English coasts are not the least fruitful in shells, though they do not produce such elegantly painted ones as the Indies. About Plymouth are found oysters, muscles, and solens, in great abundance; and there, and on most of their shores, numbers of the aures marinæ and dentalia, with pectens, which are excellent food, and many

elegant species of the chamæ and tellinæ are fished up in the sea about Scarborough and other places. Ireland affords great numbers of muscles, and some very elegant scallop shells in great abundance and the pholades are frequent on most of their shores. They have also great variety of the buccina and cochleæ, and some volutæ; and, on the Guernsey coast, a peculiarly beautiful snail, and called thence the Guernsey snail.

The coasts of Spain and Portugal afford much the same species of shells with the East Indies, but they are of much fainter colors and greatly inferior in beauty. There are, according to Tavernier and others, some rivers in Bavaria in which there are found pearls of a fine water. About Cadiz there are found very large pinnæ marinæ, and some fine buccina. The isles of Majorca and Minorca afford great variety of extremely elegant shells. The pinnae marinae are also very numerous there, and their silk is wrought into gloves, stockings, and other things. The Baltic affords a great many beautiful species, but particularly an orange-colored pecten or scallop shell, which is not found in any other part of the world.

The fresh water shells are found much more frequently, and in much greater plenty than the sea kinds; there is scarce a pond, a ditch, or a river of fresh water in any part of the world, in which there are not found vast numbers of these shells with the fish living in them. Most these shells are small, and they are of very little beauty, being usually of a plain grayish or brownish color. The English ditches afford chamæ, buccina, neritæ, and some pattellæ; but the Nile and some other rivers furnished the ancients with a species of tellina which was large and eatable, and so much superior to the common sea tellina in flavor, that it was commonly known by the name of *Tellina regia*, the 'Royal tellina.'

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. IX.

ATTEMPTS TO PRODUCE SILK FROM DIFFERENT ANIMATE CREATURES. 'The useful properties possessed by the produce of the silkworm, and the value which it has acquired among civilized communities, have, at various times, led ingenious men to seek among the works of nature for other substances, which, presenting appearances analogous to that beautiful filament, might be made equally conducive to human convenience and adornment.

'Some species of spiders are known to possess the power of not merely forming a web, but also of spinning, for the protection of their eggs, a bag somewhat similar in form and substance to the cocoon of the silkworm. At the commencement of the last century a method was discovered in France by Monsieur Bon, of procuring silk from these spiders' bags, and its use was attempted in the manufacture of several articles. The following particulars are gathered from a dissertation published at the time by M. Bon, and also from papers on the subject inserted in the volumes of the Royal Academy for the years 1710 and 1711.

'Spiders are usually classed according to their difference of color, whether black, brown, yellow, &c., or sometimes by the number and arrangement of their eyes: of these organs some possess no fewer than ten, others eight, and others again six. M. Bon has, however, noticed only two kinds of silk spiders, and these he has distinguished from each other as having either long or short legs, the last variety producing the finest quality of raw silk. According to this ingenious observer, the silk formed by these insects is equally beautiful, strong, and glossy with that formed by the bombyx. The spider spins minute fibres from fine papillæ, or small nipples, placed in the hinder part of its body. These papillæ serve the office of so many wire-drawing irons, to form and mould a viscous liquor, which after being drawn through them dries on exposure to the air, and forms the silk.

'The celebrated naturalist M. Reaumur, who likewise bestowed considerable attention on these insects, discovered that each of the papillæ consists of a number of smaller ones, so minute as not to be discernable, and only made evident by the effects produced. If the body of the spider be pressed between the fingers, the liquor from which the threads are formed flows into the papillæ, by applying the finger against which, distinct threads may then be drawn out through the several perforations of each papilla. These threads are too fine to be counted with any accuracy, but it is evident that very many are sent forth from each of the larger papillæ. This fact tends to explain the power possessed by the spider of producing threads having different degrees of tenuity. By applying more or fewer of these papillæ against the place whence it begins its web, the spider joins into one thread the almost imperceptible individual filaments which it draws from its body; the size of this thread being dependant on the number of nipples employed, and regulated by that instinct which teaches the creature to make choice of the degree of exility most appropriate to the work wherein it is about to engage. M. Bon was able to distinguish fifteen or twenty fibres in a single thread, while Reaumur relates that he has often counted as many as seventy or eighty fibres through a microscope, and perceived that there were

yet infinitely more than he could reckon; so that he believed himself to be far within the limit of truth in computing that the tip of each of the five papillæ furnished 1000 separate fibres: thus supposing that one slender filament of a spider's web is made up of 5000 fibres.

'The threads produced by spiders are of two kinds. The first, which serves only to form the web which the insect spreads to intrap its prey, is very fragile; while the second, which is used to inclose the eggs of the female, is much stronger, thus affording to them shelter from cold, and protection from other insects which might otherwise destroy them. The threads are, in this operation, wound very loosely round the eggs, in a shape resembling that of the cocoon of the silkworm, after it has been prepared and loosened for the distaff.

'When first formed, the color of these spiders' bags is gray, but, by exposure to the air, they soon acquire a blackish hue. Other spider bags might probably be found of other colors, and affording silk of better quality, but their scarcity would render any experiment with them difficult of accomplishment; for which reason M. Bon confined his attention to the bags of the common sort of the short-legged kind.

'These always form their bags in some place sheltered from the wind and rain, such as the hollow trunks of trees, the corners of windows or vaults, or under the eaves of houses. A quantity of these bags was collected by M. Bon, from which a new kind of silk was made, said to be in no respect inferior to the silk of the bombyx. It took readily all kinds of dyes, and might have been wrought into any description of silken fabric. M. Bon had stockings and gloves made from it, some of which he presented to the Royal Academy of Paris, and others he transmitted to the Royal Society of London.

'This silk was prepared in the following manner:—Twelve or thirteen ounces of the bags were beaten with the hand, or by a stick, until they were entirely freed from dust. They were next washed in warm water, which was continually changed, until it no longer became clouded or discolored by the bags under process. After this they were steeped in a large quantity of water wherein soap, saltpetre, and gum arabic had been dissolved. The whole was then set to boil over a gentle fire during three hours, after which the bags were rinsed in clear warm water to discharge the soap. They were finally set out to dry, during some days previous to the operation of carding, which was then performed with cards differing from those usually employed with silk in being much finer. By these means silk of a peculiar ash color was obtained, which was spun without difficulty. M. Bon affirmed that the thread was both stronger and finer than common silk, and that therefore fabrics similar to those made with the latter material might be manufactured from this, there being

no reason for doubting that it would stand any trials of the loom, after having undergone those of the stocking frame.

'The only obstacle, therefore, which appeared to prevent the establishing of any considerable manufacture from these spider bags was the difficulty of obtaining them in sufficient abundance. M. Bon fancied that this objection could soon be overcome, and that the art of domesticating and rearing spiders, as practised with silkworms, was to be attained. Carried away by the enthusiasm of one, who, having made a discovery, pursues it with ardor undismayed by difficulties, he met every objection by comparisons, which perhaps were not wholly and strictly founded on fact. Contrasted with the spider, and to favor his arguments, the silkworm in his hands made a very despicable figure. He affirmed that the female spider produces 600 or 700 eggs; while of the 100, to which number he limited the silkworm, not more than one half were reared to produce balls. That the spiders hatched spontaneously, without any care, in the months of August and September; that the old spiders dying soon after they have laid their eggs, the young ones live for ten or twelve months without food and continue in their bags without growing, until the hot weather, by putting their viscid juices in motion, induces them to come forth, spin, and run about in search of food.

'Mons. Bon flattered himself by this partial comparison, that if a method could be found of breeding young spiders in apartments, they would furnish a much greater quantity of bags than silkworms. Of about 700 or 800 young spiders which he kept, hardly one died in a year; whereas, according to this gentleman's estimate, of 100 silkworms not forty lived to form their cocoons. His spider establishment was managed in the following manner:—Having ordered all the short-legged spiders which could be collected by persons employed for the purpose, to be brought to him, he inclosed them in paper coffins and pots; these were covered with papers, which, as well as the coffins, were pricked over their surface with pin holes to admit air to the prisoners. The insects were duly fed with flies, and after some time it was found on inspection that the greater part of them had formed their bags. This advocate for the rearing of spiders contended that spiders' bags afforded much more silk in proportion to their weight than those of the silkworm; in proof of which he observed, that thirteen ounces yield nearly four ounces of pure silk, two ounces of which were sufficient to make a pair of stockings; whereas stockings made of common silk were said by him to weigh seven or eight ounces.

'Some persons had imagined that the spider was venomous, and

that this evil quality extended to the silk which it produced. Mons. Bon combated this prejudice by the assertion, that he had several times been bitten by spiders, when no injury had ensued; and that the silk, so far from being pernicious, had been found efficacious in stanching and healing wounds, its natural gluten acting as a kind of balsam. Determined upon extracting every possible good from this his favorite pursuit, he subjected the spider silk to chemical analysis, and obtained from it a volatile salt, preparing which in the same manner used for the *guttæ Anglicanæ* once so famous all over Europe, he produced drops which, as he believed, possessed greater efficacy than even these: he called this preparation Montpelier drops, and recommended its application in all lethargic diseases.

'The Royal Academy of Paris having considered the subject deserving of investigation, appointed M. Reaumur to inquire into the merits of this new silken material. In the course of his examination this naturalist discovered many serious objections, the narration of which will show the inexpediency of M. Bon's projected establishments. Mons. Reaumur urged that the natural fierceness of spiders rendered them wholly unfit to be bred and reared together. On distributing 4000 or 5000 into cells, in companies of from 50 to 100 or 200, it was found that the larger spiders quickly killed and ate the smaller, so that in a short time the cells were depopulated, scarcely more than one or two being found in each cell. To this propensity for mutual destruction, M. Reaumur ascribes the scarcity of spiders in comparison with the vast number of eggs which they produce. But if even it were possible to change their warlike nature and bring these insects together in peaceful community, there are other objections to deter from the attempt.

'M. Reaumur affirmed, that the silk of the spider is inferior to that of the silkworm, both in lustre and strength, and that it produced proportionally less material available to purposes of manufacture. All this was satisfactorily proved; although in his reasoning some little exaggeration was likewise employed in opposition to the coloring of M. Bon. The thread of the spider's web was found capable of sustaining a weight of only two grains without breaking; and the filament of the bag, although much stronger than this, could only sustain thirty-six grains, while that of the silkworm will support a weight of two drachms and a half. "Thus five" (four?) "threads of the spider," said M. Reaumur, "must be brought together to equal one thread of the silkworm." Now it is impossible that these should be applied so justly over one another as not to leave little vacant spaces between them, whence

the light will not be reflected; and, consequently, a thread thus compounded cannot equal in lustre a solid thread. It is another great disadvantage of the spider's silk, that it cannot be wound off the ball like that of the silkworm, but must necessarily be carded; and therefore its evenness, which contributes so materially to its lustre, is destroyed. That this effect was in reality produced, is further confirmed by the testimony of M. le Hire, who, when the stockings of M. Bon were presented to the Royal Academy, immediately noticed their want of lustre.

'Another objection urged by M. Reaumur against the rearing of spiders was the small quantity as well as deficient quality of the silk they produce. In making a comparison in this respect between them and the silkworm, extreme cases were taken, that the conclusion might be rendered more striking. "The largest cocoons," said this naturalist, "weigh four and the smaller three grains each; spiders' bags do not weigh above one grain each, and, after being cleared of their dust, have lost two thirds of this weight." He calculated, therefore, that the work of twelve spiders only equals that of one silkworm; and that a pound of silk would require for its production 27,648 insects. But as the bags are wholly the work of the females, who spin them as a deposit for their eggs, it follows that 55,296 spiders must be reared to yield one pound of silk: yet even this will be obtained from only the best spiders, those large ones ordinarily seen in gardens, &c., yielding not more than a twelfth part the silk of the others. The work of 280 of these would, therefore, not yield more silk than the produce of one industrious silkworm, and 663,552 of them would furnish only one pound of silk! This latter calculation is however decidedly erroneous in its several steps, and appears rather to be a flight of the imagination than the result of sober induction. The advantages of the culture of silk from the silkworm, when compared with its production from spiders, are so prodigious, and at the same time so evident, that to prove the futility of M. Bon's scheme needed not the aid of exaggeration.

'Human ingenuity has been somewhat more successfully exercised in seeking, many feet below the surface of the ocean, for slender filaments, the produce of an animal in almost a vegetative state of existence.

'The *pinna* belongs, like the common edible muscle, to the order of the *Vermes testacea*. The animal is a limax, its shell is bivalve, fragile, and furnished with a beard; the valves hinge without a tooth. The pinna does not fasten itself to rocks in the same situation as the muscle, but sticks its sharp end into the mud or sand, while the rest of the shell remains at liberty to open in the

water. In common with the muscle, it has the power of spinning a viscid matter from its body, in the manner of the spider and caterpillar. Although the pinna is vastly larger than the muscle, its shell being often found two feet long, the threads which it produces are much more delicate and slender than those of the muscle, and scarcely inferior in fineness and beauty to the single filament of the comparatively minute silkworm. Threads so delicately thin, as may readily be imagined, do not singly possess much strength; but the little power of each is made up by the aggregate of the almost infinite number which each fish puts forth to secure itself in a fixed situation, and to preserve it against the rolling of the waves. The threads are, however, similar in their nature to those of the muscle, differing only in their superior fineness and greater length. These fish have, therefore, been distinguished by some naturalists, the one as the silkworm, the other as the caterpillar of the sea.

'It was always well known that muscles have the power of affixing themselves either to rocks or to the shells of one another, in a very firm manner; yet their method of effecting this was not understood until explained through the accurate observations of M. Reaumur. He was the first naturalist who ascertained that if, by any accident, the animals were torn from their hold, they possessed the power of substituting other threads for those which had been broken or injured. He found that if muscles, detached from each other, were placed in any kind of vessel and then plunged into the sea, they contrived in a very short time to fasten themselves both to the sides of the vessel and to one another's shells: in this process, the extremity of each thread seemed to perform the office of a hand in seizing upon the body to which it would attach itself.

'The threads issue from the shell at that part where it naturally opens, and, in affixing themselves to any substance, form numerous minute cables, by aid of which the fish steadies itself in the water. Each animal is furnished with an organ, which it is difficult to designate by any name, since it performs the office of so many members, and is the only indicator of the existence of vital powers in the creature. It is by turns a tongue, an arm, and sometimes a leg. Its shape resembles that of a tongue, and it is, therefore, most frequently called by that name. Whenever the fish requires to change its place, this member serves to drag its body forward, together with its cumbrous habitation: in performing its journey the extremity of this organ, which may then be called a leg, is fixed to some solid body, and being then contracted in its length, the whole fish is necessarily drawn towards the spot where it has fixed itself; and by a repetition of these movements,

the animal arrives at his destination. It is not often that the organ is put to this use, as the pinna is but little addicted to locomotion : some naturalists indeed affirm that it is always stationary. The use to which the tongue is most frequently applied is that of spinning the threads. Although this body is flat, and similar in form to a tongue through the greater part of its length, it becomes cylindrical about the base or root, where it is much smaller than in any other part : at this lower end are several ligatures of a muscular nature, which hold the tongue firmly fixed against the middle of the shell ; four of these cords are very apparent, and serve to move the tongue in any direction according to the wants of the fish. Through the entire length of this member there runs a slit, which pierces very deeply into its substance, so as almost to divide it into two longitudinal sections ; this slit performs the office of a canal for the liquor of which the threads are formed, and serves to mould them into their proper form : this canal appears externally like a small crack, being almost covered by the flesh from either side, but internally it is much wider, and is surrounded by circular fibres. The channel thus formed extends regularly from the tip to the base of the tongue, where it partakes of the form of the member and becomes cylindric, forming there a close tube or pipe in which the canal terminates. The viscid substance is moulded in this tube into the form of a cord, similar to the threads produced from it, but much thicker, and from this cord all the minute fibres issue and disperse. The internal surface of the tube in which the large cord is formed is furnished with glands for the secretion of the peculiar liquor employed in its production, and which liquor is always in great abundance in this animal as well as in muscles.

'Reaumur observed, that although the workmanship, when completed, of the land and sea animals, is the same, the manner of its production is very different. Spiders, caterpillars, and the like, form threads of any required length, by making the viscous liquor of which the filament is formed pass through fine perforations in the organ appointed for this spinning. But the way in which muscles form their thread is very different ; as the former resembles the work of the wire-drawer, so does the latter that of the founder who casts metals in a mould. The canal of the organ destined for the muscle's spinning is the mould in which its thread is cast, and gives to it its determinate length.

'Reaumur learned the manner of the muscle performing the operation of spinning by actually placing some of these fish under his constant inspection. He kept them in his apartment in a vessel filled with sea water, and distinctly saw them open their shells

and put forth the tongue. They extended and contracted this organ several times, obtruding it in every direction, as if seeking the fittest place whereon to fix their threads. After these trials had been often repeated, the tongue of one was observed to remain for some time on the spot chosen, and being then drawn back with great quickness, a thread was very easily discerned, fastened to the place: this operation was repeated, until all the threads were in sufficient number, one fibre being produced at each movement of the tongue.

'The old threads were found to differ materially from those newly spun, the latter being whiter, more glossy, and more transparent than the former, and it was thence discovered that it was not the office of the tongue to transfer the old threads one by one to the new spots where they were fixed, which course M. Reaumur had thought was pursued. The old threads once severed from the spot to which they had been originally fixed were seen to be useless, and that every fibre employed by the fish to secure itself in a new position was produced at the time it was required; and, in short, that nature had endowed some fish, as well as many land insects, with the power of spinning threads, as their natural wants and instincts demanded. This fact was established incontrovertibly by cutting away, as close to the body as they could be safely separated, the old threads, which were always replaced by others in as short a space of time as was employed by other muscles not so deprived in fixing themselves.

'"The pinna and its cancer friend" have on more than one occasion been made subjects for poetry. There is doubtless some foundation for the fact of the mutual alliance between these aquatic friends which has been thus celebrated; yet some slight coloring may have been borrowed from the regions of fancy to adorn the verse, and even the prose history of their attachment may be exposed to the same objection.

'These fish are found on the coasts of Provence and Italy, and in the Indian ocean. The largest and most remarkable species inhabits the Mediterranean Sea.

'The scuttle fish *, a native of the same seas as the pinna, is its deadly foe, and would quickly destroy it, if it were not for its faithful ally. In common with all the same species, the pinna is without the organs of sight, and could not, therefore, unassisted, be aware of the vicinity of its dangerous enemy. A small animal of the crab kind, itself destitute of a covering, but extremely quick-sighted, takes refuge in the shell of the pinna, whose strong call

* This species is the Octopodia, with eight arms connected at theirb ottoms by a membrane: it is the Polypus of Pliny.

careous valves afford a shelter to her guest, while he makes a return for this protection by going forth in search of prey. At these times the pinna opens her valves to afford him egress and ingress: if the watchful scuttle fish now approach, the crab returns immediately with notice of the danger to her hostess, who, timely warned, shuts her door and keeps out the enemy. When the crab has, unmolested, succeeded in loading itself with provisions, it gives notice by a gentle noise at the opening of the shell, and when admitted, the two friends feast together on the fruit of its industry. It would appear an arduous, nay, almost an impossible task, for the defenceless and diminutive crab, not merely to elude its enemies and return home, but likewise to obtain a supply of provender sufficient to satisfy the wants of its larger companion. The following different account of the nature of this alliance is much more in agreement with probability :—

'Whenever the pinna ventures to open its shell, it is immediately exposed to the attacks of various of the smaller kinds of fish, which, finding no resistance to their first assaults, acquire boldness and venture in. The vigilant guard, by a gentle bite, gives notice of this to his companion, who, upon this hint, closes her shell, and having thus shut them in makes a prey of those who had come to prey upon her: when thus supplied with food she never fails to share her booty with so useful an ally.

'We are told that the sagacious observer, Dr. Hasselquist, in his voyage about the middle of the last century to Palestine, which he undertook for objects connected with the study of natural history, beheld this curious phenomenon, which, though well known to the ancients, had escaped the attention of the moderns.

'It is related by Aristotle that the pinna keeps a guard to watch for her, which grows to her mouth, and serves as her caterer: this he calls pinnophylax, and describes as a little fish with claws like a crab. Pliny observes, that the smallest species of crab is called the pinnotores, and being from its diminutive size liable to injury, has the prudence to conceal itself in the shells of oysters. In another place he describes the pinna as of the genus of shell-fish, with the further particulars that it is found in muddy waters, always erect, and never without a companion, called by some pinnotores, by others pinnophylax; this being sometimes a small squill, sometimes a crab, which remains with the pinna for the sake of food.

'The description of the pinna by the Greek poet Oppianus, who flourished in the second century, has been thus given in English verse :—

"The pinna and the crab together dwell,
For mutual succour in one common shell;
They both to gain a livelihood combine,
That takes the prey, when this has given the sign;
From hence this crab, above his fellows famed,
By ancient Greeks was Pinnotores named."

'It is said that the pinna fastens itself so strongly to the rocks, that the men who are employed in fishing it are obliged to use considerable force to break the tuft of threads by which it is secured fifteen, twenty, and sometimes thirty feet below the surface of the sea.

'The fishermen at Toulon use an instrument called a cramp for this curious pursuit. This is a kind of iron fork, whose prongs are each about eight feet in length and six inches apart, and placed at right angles to the handle, the length of which is regulated by the depth of water. The pinnæ are seized, separated from the rock, and raised to the surface by means of this instrument.

'The threads of the pinna have from very ancient time been employed in the manufacture of certain fabrics. This material was well known to the ancients, as some suppose, under the name of byssus, and was wrought in very early times into gloves and other articles of dress and ornament. It appears that robes were sometimes made of this produce, since we learn from Procopius that a robe composed of byssus of the pinna was presented to the satraps of Armenia by the Roman emperor.

'A writer of the year 1782 evidently refers to the pinnæ marinæ, when he says, "The ancients had a manufacture of silk, and which, about forty years ago, was revived at Tarento and Regio in the kingdom of Naples. It consists of a strong brown silk, belonging to some sort of shell, of which they make caps, gloves, stockings, waistcoats, &c., warmer than the woollen stuffs, and brighter than common silk. I have seen such kind of silk in shells myself; I think it was of the pecten kind, but cannot be sure."

'Several beautiful manufactures are wrought with these threads at Palermo. They are in many places the chief objects of the fishery, and the silk is found to be excellent. The produce of a considerable number of pinnæ is required to make only one pair of stockings. The delicacy of this singular thread is such that a pair of stockings made of it can be easily contained in a snuff box of ordinary size. Some stockings of this material were presented, in the year 1754, to pope Benedict XIV.; and, notwithstanding their extreme fineness, were found to protect the legs alike from cold and heat. Stockings and gloves of this production, however thin, are too warm for common wear, but are esteemed

useful in gouty and rheumatic cases. This great warmth of the byssus, like the similar quality in silk, results probably from both being imperfect conductors of heat as well as of electricity.

'It is not probable that this material will ever be obtained in much abundance, or that it will cease to be a rarity, except in the places of its production. It is never seen in England save in the cabinets of the curious.

'The appearance and general characteristics of the produce of the pinna, the spider, and the silkworm, are so similar, as to have acquired for them one generic name. If all their constituent parts be alike, it forms another among the numerous subjects for surprise and admiration, excited by contemplating the wonderful works of nature, that the same silky principle can be alike elaborated from the fish, the fly, and the mulberry leaf.'

THE MICROSCOPE.

NO. III.

ACTIVE MOLECULES, CONTINUED.

BUTTERFLIES AND MOTHS. We cannot enumerate all the different sorts of these beautiful insects, and it is impossible to describe the variety and splendor of their plumages, surpassing all the magnificence of the richest and most costly dress. All the butterfly and moth tribes are bred from caterpillars. The number of these insects is very great; Linnæus reckoned eight or nine hundred different kinds, some of which are extremely rare, and only found in particular places. The legs, antennæ, the eyes, in fact every part, when examined, afford the highest entertainment.

DUST OF THE FEATHERS OF A BUTTERFLY'S WING. The wings in themselves are, like the common fly's, transparent, but owe their opacity to the beautiful minute feathers which cover them; and, examined by the microscope, nothing can exceed the beautiful and regular arrangement of these little substances, which, by their different colors, serve to paint the wing, and by their regular layers, resembles the tiles of a house-top. Carefully brush some of the dust off on your slide, between two pieces of talc, place it under the microscope, and you will be richly rewarded for the trouble taken. With a high power and strong light, beautiful prismatic colors and lines may be discovered.

THE HAIR-LIKE ANIMALCULE. This wonderful little insect, from its resemblance to a fine hair, is called the hair-like insect. All its motions are extremely slow, and require much patience and attention in the observer: it has neither feet nor fins, but appears perfectly smooth and transparent. These creatures are so small that millions might be contained in a square inch; they are found in the sediment or mud in ditches, and sometimes in vegetable infusions; a quantity of this should be procured, and put into a glass vessel; myriads may be seen to crawl up the sides of the glass.

THE CAT ANIMAL. In the same water or sediment may be found the oat animalcule, so called from its resemblance to a grain of oats; it is inclosed in a shell, which it opens and shuts, but can change its place only by sudden jerks or leaps. This little creature is so extremely small, that it requires the greatest magnifier to examine it.

CHEESE MITES. Mites are those minute creatures found in cheese. To the eye they appear like moving particles of dust, but the microscope discovers them to be animals, perfect in all their parts, having as regular a figure, and performing all the functions of life as well as those animals which are many millions times their size. The head is formed like a pig's, they have two small eyes, and are extremely quick-sighted. Each leg has six joints, with claws. The body is covered with long hair. These creatures, male and female, are produced from the eggs, and come forth perfect insects; though extremely minute, you may sometimes see them break the shell and force their way out. The egg itself is a curious object for the microscope. The mites may be kept alive for months, between two glasses, or in the object box. The best method of preserving them for the microscope is to put some bits of old cheese into a small phial and pierce some holes in the cork for air: by gently heating the bottle, they will crawl up the sides, and through the holes of the cork, and can be brushed off with a camel-hair brush, free from dirt, on the glass. Mites may also be found in stale flour, or in the dust of the dried fig. Mr. T. Carpenter, among many other curious anatomical dissections, has succeeded in dissecting the jaws of one of these insects, and has displayed them most beautifully between two pieces of glass: they are, as may be supposed, extremely delicate, but can be seen very distinctly.

METEOROLOGICAL JOURNAL,

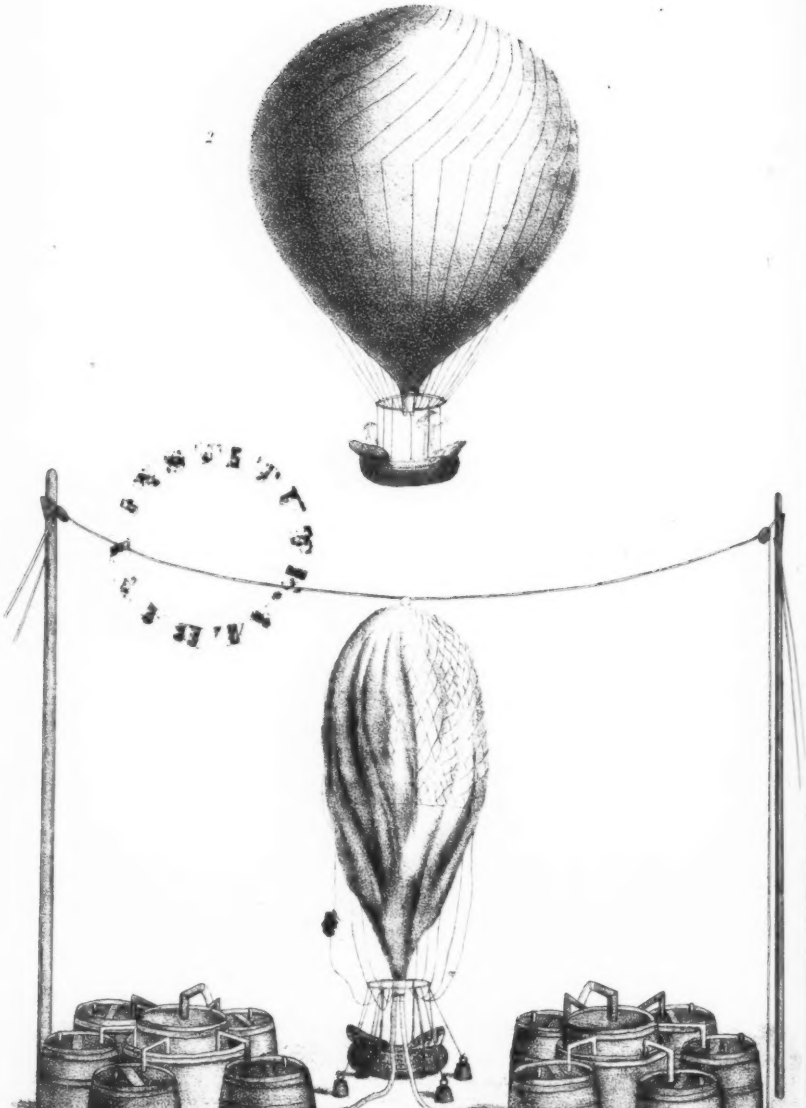
KEPT AT BOSTON, FOR JULY, 1832.

[From the Daily Advertiser.]

Day.	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.	
	Morn.	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inches.*	
1	64	87	78	30.11	30.08	30.07	Fair	Fair	Fair	S. W.	S. W.	S. W.		
2	73	91	76	30.04	30.01	30.00	Fair	Fair	Fair	S. W.	S. W.	S. W.		
3	72	88	76	29.98	29.90	29.89	Fair	Fair	Fair	S. W.	S. W.	S. W.		
4	67	73	68	29.98	30.02	30.02	Fair	Fair	Fair	N. E.	E.	S. W.		
5	62	81	68	30.12	30.12	30.10	Fair	Fair	Fair	S. W.	S. W.	S. W.		
6	63	86	72	30.08	30.04	30.01	Fair	Fair	Fair	S. W.	N. E.	N. E.		
7	67	71	55	29.95	29.96	30.02	Fair	Fair	Cloudy	S. W.	N. E.	N. E.		
8	55	60	56	30.00	30.00	29.97	Cloudy	Cloudy	Cloudy	N. E.	N. E.	N. E.		
9	56	57	52	29.91	29.90	29.88	Cloudy	Cloudy	Rain	N. E.	N. E.	N. E.		
10	53	60	54	29.81	29.87	29.92	Cloudy	Cloudy	Cloudy	N. E.	N. E.	N. E.	0.33	
11	51	51	50	29.89	29.88	29.80	Cloudy	Rain	Cloudy	N. E.	N. E.	N. E.	0.21	
12	52	62	59	29.72	29.72	29.75	Fair	Show's	Fair	N. W.	S. W.	N. W.	0.06	
13	56	68	60	29.71	29.70	29.78	Fair	Fair	Fair	S. W.	N. W.	N. W.		
14	54	68	60	29.82	29.85	29.95	Fair	Fair	Fair	N. W.	E.	S. W.	0.02	
15	55	68	62	30.01	30.05	30.11	Fair	Fair	Fair	N. W.	W.	N. W.		
16	54	70	65	30.10	30.10	30.10	Fair	Fair	Fair	N. W.	E.	S. W.	0.01	Show's
17	64	68	67	30.11	30.12	30.15	Cloudy	Fair	Fair	S. W.	E.	S. W.		
18	62	82	70	30.15	30.15	30.05	Fair	Fair	Fair	S. W.	S. W.	S. W.		
19	68	86	70	29.98	29.95	29.75	Fair	Fair	Fair	S. W.	S. W.	S. W.	0.21	Show's
20	68	80	73	29.72	29.71	29.74	Fair	Fair	Cloudy	N. W.	N. W.	N. W.		
21	66	68	60	29.70	29.65	29.78	Rain	Cloudy	Fair	S. W.	N. E.	N. W.	0.09	
22	58	68	64	29.83	29.95	30.02	Fair	Fair	Fair	N. W.	E.	S. W.		
23	58	70	61	30.12	30.15	30.18	Fair	Fair	Fair	N. W.	W.	S. W.		
24	53	74	63	30.15	30.10	30.03	Cloudy	Fair	Cloudy	S. W.	S. W.	S. W.	0.73	Show's
25	54	74	64	29.90	29.90	29.82	Cloudy	Fair	Fair	N. W.	E.	S. W.	0.13	Show's
26	58	68	62	29.79	29.80	29.90	Cloudy	Fair	Fair	N. W.	N. W.	S. W.		
27	58	76	65	29.96	30.02	30.11	Fair	Fair	Fair	S. W.	S. W.	S. W.		
28	60	81	67	30.12	30.12	30.12	Fair	Fair	Fair	S. W.	S. W.	S. W.		
29	65	81	69	30.10	30.09	30.05	Fair	Fair	Fair	S. W.	S. W.	S. W.		
30	68	81	74	30.00	30.01	30.03	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	1.12	Rain & Show's
31	70	76	68	30.06	30.10	30.12	Cloudy	Fair	Cloudy	S. W.	E.	S. W.		

Depth of rain fallen 2.91 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.



Pendleton's Lithog.' Bos.ⁿ

Mode of inflating the Balloon
with Hydrogen Gas.